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FOREST PLANTING LEAFLET.

BLACK WALNUT (Juglans nigra).

FORM AND SIZE.

When grown in the open the black walnut is a rather symmetrical tree, with a massive crown, short trunk, and a form similar to that of open grown oaks and chestnuts. In the forest the trunk lengthens into a tall, tapering column, often with no limbs for a distance of 50 or 60 feet, and surmounted by a much reduced crown. The foliage is thin, and never completely shades the ground. On the lower mountain slopes of the Carolinas a height of 110 feet and a diameter of from 5 to 6 feet is often attained. The usual height of the mature forest-grown tree is from 70 to 90 feet, and the diameter from 30 to 45 inches. Trunks of low, spreading trees in the open often measure over 6 feet in diameter.

RANGE.

Black walnut is one of the most widely distributed and valuable of our deciduous trees. In nature it grows sparingly from southwestern New England westward, through New York, Ontario, Michigan, and Wisconsin, to southern Minnesota, thence southward, with central Nebraska and Kansas as the western limit, to south central Texas and Florida. It does not appear along the Gulf or the South Atlantic seaboard, and is much more abundant in the Central than in the Eastern States.

Although of fair size wherever found, black walnut attains its best development in the deep hollows of the western slope of the southern

Alleghenies, on the rich bottom lands along the Mississippi and Ohio rivers, and in Arkansas, Missouri, eastern Nebraska, Kansas, and Indian Territory. In the mountains of the Carolinas and Tennessee it occurs in mixture with oaks and chestnut, while in the original hardwood forests in the river valleys of Ohio, Indiana, Illinois, and Kentucky it is found associated with the maples, hickories, oaks, basswood, cherry, and other hardwoods of the region, though not always intermingling closely with them. West of the Mississippi the walnut is confined to river valleys and moist situations. In this western region it is found associated with the coffeetree, green ash, hackberry, basswood, and white elm.

The walnut is nowhere a gregarious tree, but usually occurs in scattered groups or as isolated individuals among other species. Within the limits of its range there are regions where it is almost unknown, while within a few miles it may be common, though conditions in both localities seem identical.

The natural range has been increased both to the east and west by planting. In Rhode Island, eastern Massachusetts, and southern New Hampshire and Maine the tree was probably not native, but has been planted in small quantities for its nuts, and grows well. In Iowa and eastern Nebraska plantations of black walnut have been successfully made. Plantations have been made as far west as Salt Lake City, southern Idaho, and throughout California, with evident success. In California the black walnut has been planted to a very limited extent for timber, to a greater extent for ornament and the yield of nuts. In the San Joaquin and Sacramento valleys the California black walnut, native to the southern part of the State, has been grown successfully instead of the eastern black walnut.

HABITS AND GROWTH.

The ideal conditions for growth are found in the rich, moist soil of bottom lands or on fertile hillsides which are protected from cold, sweeping winds. A calcareous soil or a sandy loam, containing a large quantity of humus, overlying a deep subsoil of gravel and a water table in which the long taproots can find a continual supply of moisture, furnishes the best conditions for growth. The surface soil should be moist, but not wet, and the subsoil porous.

While not especially adapted to widely varying conditions, the black walnut will grow in many localities outside of its natural range; but its form and rate of growth are appreciably affected by its environment. Throughout the entire Middle West south of the forty-fifth parallel, planting on limited areas may be attempted with fair prospects of success on all fertile prairie land, and especially in coves, valleys, and extensive bottom lands where the requisite moisture is present and partial protection from the wind can be had.

This latter requirement may be secured by starting the plantation in the lee of a natural wind-break or by planting a shelter belt of hardy, rapid-growing species on the exposed sides. The most favorable range for economic planting is in the fertile valleys of the Ohio and Mississippi rivers and their tributaries and on the bottom lands of the Carolinas, Georgia, Tennessee, Kentucky, Missouri, eastern Nebraska, Kansas, and Oklahoma. On upland soils, especially in the West, where there is a stiff subsoil, the species makes slow growth. In the southwestern plains the dry, hot weather of summer is often injurious, while in Minnesota and the Dakotas the cold of winter often kills back the season's shoots.

The black walnut is intolerant of shade. The foliage of a walnut plantation is thin, seldom shading the ground to such an extent as to prevent the growth of grass and weeds.

In good soil the rate of growth is fairly rapid and is continued up to mature age. In the best situations planted trees occasionally make a diameter growth of nearly an inch each year, but under average conditions an increase of one-fourth to one-third inch is all that may be expected. A tree 12 to 15 years old will begin to bear fruit, and lumber will be produced in forty to sixty years. Along the northern limit of its range it is somewhat susceptible to sun scald, and should be protected from the wind and sun by hardier species.

Many tree defoliators and borers attack the walnut, but seldom do serious damage, since they are mostly of local distribution, and the damage done by them is limited in extent. In case insects cause serious damage, specimens, accompanied by a full description of their work, should be sent to the Bureau of Entomology of the United States Department of Agriculture for identification and suggestion as to methods of control.

ECONOMIC USES.

The wood of walnut is heavy, hard, strong, and of coarse texture. The sapwood is narrow and whitish in color and the heartwood is a chocolate brown, which deepens with age and exposure. The wood shrinks moderately in drying, and if care is taken dries without checking. It works and stands well, takes a good polish, and is valuable as a cabinet wood. It is very durable in contact with the soil, as only the sapwood decays.

Walnut was formerly much used for furniture and interior finish, especially in churches; in cabinetwork, for gunstocks, tool handles, and carriage hubs, and to some extent in the construction of ships. Formerly more abundant, it was used for fence posts and made into shingles. At present the market is much better in Europe than at home, and large amounts are exported in the form of logs 10 to 20 feet long and 15 to 30 inches square. However, 30,000,000 feet B. M. of walnut were sawed in this country during the year 1905.

The price of walnut lumber is little, if at all, higher than it was twenty-five years ago; about $100 per thousand is paid for the best grades and $50 to $70 for medium grades. The average value of the lumber manufactured in 1900, as given by the last census, was $37 per thousand. Logs of unusually fine grain sometimes bring high prices for veneer manufacturing.

Walnut under favorable condition will reach post size in from ten to twelve years. However, timber of this size contains so large a percentage of sapwood that it is not first class for fence posts. If durable fence-post material is desired, the rotation should not be less than twenty-five years, and forty years would be more profitable, since the trees must have time to mature a considerable amount of heartwood.

The greatest returns will be realized from this species when it is planted with a view to growing saw timber. If a walnut plantation is established for this purpose, it is advisable to underplant with some tolerant tree that may be cut with profit in twenty or twenty-five years, leaving the walnut as the permanent stand until merchantable size is attained. As this will require a period of about seventy-five years, extensive walnut plantations are not advisable unless a long-time investment is sought.

METHODS OF PROPAGATION.

Under natural forest conditions the black walnut does not reproduce readily, and becomes almost extinct wherever lumbered clear. The tree does not reproduce by suckers and only sparingly from stump sprouts; squirrels usually destroy many of the fallen nuts and young trees are killed by dense shade.

The nuts may be stored over winter by stratifying them in moist sand or leaves in a sheltered place out of doors. In stratifying, 3-inch layers of sand should alternate with single layers of nuts. Boards should be placed around the edge of this store of nuts and the top protected against burrowing rodents. The sand should be kept moist, and the whole mass allowed to freeze.

For extensive and satisfactory propagation of the species, artificial planting is the only sure method. Because of the long taproots and consequent difficulty in transplanting, nursery culture is in general not advisable. It can, however, be made successful if root pruning is practiced and great care taken in moving the plants. Nursery culture, if attempted, should be conducted as follows:

The nuts should be planted at 6-inch intervals in nursery rows 3 feet apart, and covered 1 to 1½ inches deep. A preliminary freezing of the nuts will be beneficial rather than injurious. The plants in one year should attain a height of 12 to 14 inches, and may be transplanted to the permanent site in the spring when 1 year old.

PLANTING.

The plants may be set in furrows, or in holes dug with a spade, care being taken to keep the roots from drying out, and to pack the earth firmly around them. In general the better plan is to omit nursery culture altogether and plant the nuts in their permanent place in the plantation. Either fall or spring planting may be practiced, but spring planting is usually best.

In the East a furrow or a series of holes the proper distance apart will be sufficient for the reception of the seeds. On the plains and prairies of the West, greater care in preparing the soil is essential. The sod should be broken, and the ground put in corn or some other common crop for one or two years. The nuts may then be planted in the spring in shallow furrows and covered with a plow to a depth of 2 or 3 inches and the ground well firmed down. The rows should be straight in at least one direction, to facilitate cultivation. The spacing will vary in different localities. An interval of 6 or 8 feet apart each way is recommended.

Since the black walnut is a long-lived, light-demanding tree, it may with advantage be combined in the plantation with a more heavily foliaged species. The associate trees should be allowed to grow until they clear the lower limbs from the walnut and stimulate it to a rapid upward growth, when they should be removed and the long-lived species left to finish its growth alone. Desirable trees for such a mixture are the hardy catalpa, hackberry, Osage orange, and boxelder. When the walnut and another species are thus combined, the walnut should be given two to three years' start in order that it may not be overtopped.

CULTIVATION AND CARE.

The plantation should be cultivated until the tops of the trees meet. During the first three years corn may be grown between the rows to give additional returns from the soil.

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